

WHAT IS CLAIMED IS:

1. An image processing apparatus for magnifying an image, comprising:
a differentiability judgment portion for judging differentiability in an
5 original image to be magnified, based on human vision characteristics; and
a magnification processing portion for generating a magnified image
of the original image by magnifying the original image in a manner that is
adapted to the differentiability judged by the differentiability judgment
portion.

2. The image processing apparatus according to claim 1, wherein the
differentiability judgment portion judges the differentiability based on
gradation characteristics of human vision.

3. The image processing apparatus according to claim 1, wherein the
differentiability judgment portion comprises:

a decomposing portion for decomposing the original image into a
plurality of constituent images, based on spatial frequency; and

a threshold processing portion for determining the differentiability of
20 each of the constituent images by classifying the plurality of constituent
images with a predetermined threshold value based on human vision
characteristics;

wherein the magnification processing portion magnifies the
constituent images obtained with the decomposing portion in a manner that
25 is adapted to the differentiability determined by the threshold processing
portion for each of the constituent images, and generates a magnified image
of the original image by combining the magnified constituent images.

4. The image processing apparatus according to claim 3, further
30 comprising an adjusting portion for adjusting the predetermined threshold.

5. The image processing apparatus according to claim 1, wherein the differentiability judgment portion comprises:

a filter portion having filter characteristics approximating human vision characteristics;

a differential generating portion for generating a differential between the original image and the image obtained by passing the original image through the filter portion; and

a differentiability determining portion for determining the differentiability in the original image based on the differential.

6. The image processing apparatus according to claim 5, further comprising an adjusting portion for adjusting the filter characteristics of the filter portion.

7. The image processing apparatus according to claim 1, wherein the magnification processing portion comprises:

a plurality of image magnification portions for performing different types of image magnification processes on the original image; and

a selection portion for selecting from the plurality of image magnification portions the image magnification portion that is to generate the magnified image of the original image in accordance with the differentiability judged by the differentiability judgment portion.

8. The image processing apparatus according to claim 7, wherein the differentiability judgment portion judges whether the differentiability in the original image is high or low;

wherein the magnification processing portion comprises, as the plurality of image magnification portions, a first image magnification portion for magnifying the original image while preserving a spatial frequency of the

original image, and a second image magnification portion for magnifying the original image while emphasizing edges of the original image; and

wherein the selection portion selects the first image magnification portion if the differentiability has been judged to be low by the differentiability judgment portion, and selects the second image magnification portion if the differentiability has been judged to be high by the differentiability judgment portion.

9. The image processing apparatus according to claim 1,
wherein the differentiability judgment portion judges whether the differentiability in the original image is high or low; and

wherein, if the differentiability has been judged to be low by the differentiability judgment portion, the magnification processing portion carries out the image magnification process after a filtering process with filter characteristics approximating human vision characteristics has been performed.

10. The image processing apparatus according to claim 9, wherein the magnification processing portion comprises:

a filter portion that has filter characteristics approximating human vision characteristics and through which the original image is passed;

a selection portion for selecting from the image obtained by passing the original image through the filter portion, an image portion corresponding to an image portion of the original image whose differentiability has been judged to be low, if the differentiability has been judged to be low by the differentiability judgment portion, and for selecting from the original image, an image portion whose differentiability has been judged to be high, if the differentiability has been judged to be high by the differentiability judgment portion; and

an image magnification portion for magnifying, while emphasizing

edges, an image made of the image portions selected by the selection portion.

11. The image processing apparatus according to claim 1, further comprising:

5 a measuring portion for measuring a visual distance from a display surface on which the magnified image obtained by magnifying the original image with the magnification processing portion is to be displayed to a viewpoint of a person that is to view the magnified image; and

an adjusting portion for adjusting a judgment criterion of the
10 differentiability in the differentiability judgment portion based on the visual distance.

12. The image processing apparatus according to claim 1, further comprising:

15 a partitioning portion for partitioning the original image into a plurality of partial images; and

a control portion for causing the differentiability judgment portion to judge the differentiability of each of the partial images obtained with the partitioning portion, based on human vision characteristics, and for causing
20 the magnification processing portion to magnify the partial images in a manner that is adapted to their respective judged differentiability.

13. An image processing method for magnifying an image, comprising:

a differentiability judgment step of judging differentiability in an
25 original image to be magnified, based on human vision characteristics; and

a magnification processing step of generating a magnified image of the original image by magnifying the original image in a manner that is adapted to the differentiability judged based on the human vision characteristics.

14. The image processing method according to claim 13, wherein in the differentiability judgment step, the differentiability is judged based on gradation characteristics of human vision.

5 15. The image processing method according to claim 13, wherein the differentiability judgment step comprises:

a decomposition step of decomposing the original image into a plurality of constituent images, based on spatial frequency; and

10 a threshold processing step of determining the differentiability of each of the constituent images by classifying the plurality of constituent images with a predetermined threshold value based on human vision characteristics;

wherein in the magnification processing step, the constituent images obtained in the decomposition step are magnified in a manner that is adapted to the differentiability determined by the threshold processing step for each of the constituent images, and a magnified image of the original image is generated by combining the magnified constituent images.

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16. The image processing method according to claim 13, wherein the differentiability judgment step comprises:

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a differential generation step of generating a differential between the original image and the image obtained by passing the original image through a filter having filter characteristics that approximate human vision characteristics; and

25 a differentiability determination step of determining the differentiability in the original image based on the differential.

17. The image processing method according to claim 13, wherein the magnification processing step comprises:

30 a selection step of selecting an image magnification process from

different types of image magnification processes that have been prepared in advance, in accordance with the differentiability judged with the differentiability judgment step; and

an image magnification step of magnifying the original image with
5 the selected image magnification process.

18. The image processing method according to claim 13,
wherein in the differentiability judgment step, it is judged whether
the differentiability in the original image is high or low; and

10 wherein, if the differentiability has been judged to be low in the
differentiability judgment step, the image magnification process is carried
out in the magnification processing step after a filtering process with filter
characteristics approximating human vision characteristics has been
performed.

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19. The image processing method according to claim 13, further
comprising:

a measurement step of measuring a visual distance from a display
surface on which the magnified image obtained by magnifying the original
20 image in the magnification processing step is to be displayed to a viewpoint
of a person that is to view the magnified image; and

an adjustment step of adjusting a judgment criterion of the
differentiability in the differentiability judgment step based on the visual
distance.

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20. The image processing method according to claim 13, further
comprising:

a partition step of partitioning the original image into a plurality of
partial images;

30 wherein in the differentiability judgment step, the differentiability of

each of the partial images obtained with the partition step is judged based on human vision characteristics; and

wherein in the magnification processing step, the partial images are magnified in a manner that is adapted to their respective judged
5 differentiability.

21. An image processing program for magnifying an image, the program, when executed by a computer, causing the computer to perform:

a differentiability judgment step of judging differentiability in an
10 original image to be magnified, based on human vision characteristics; and

a magnification processing step of generating a magnified image of the original image by magnifying the original image in a manner that is adapted to the differentiability judged based on the human vision characteristics.

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22. The image processing program according to claim 21, wherein in the differentiability judgment step, the differentiability is judged based on gradation characteristics of human vision.

20 23. The image processing program according to claim 21, wherein the differentiability judgment step comprises:

a decomposition step of decomposing the original image into a plurality of constituent images, based on spatial frequency; and

a threshold processing step of determining the differentiability of
25 each of the constituent images by classifying the plurality of constituent images with a predetermined threshold value based on human vision characteristics;

wherein in the magnification processing step, the constituent images obtained in the decomposition step are magnified in a manner that is
30 adapted to the differentiability determined by the threshold processing step

for each of the constituent images, and a magnified image of the original image is generated by combining the magnified constituent images.

24. The image processing program according to claim 21, wherein the
5 differentiability judgment step comprises:

a differential generation step of generating a differential between the original image and the image obtained by passing the original image through a filter having filter characteristics that approximate human vision characteristics; and

10 a differentiability determination step of determining the differentiability in the original image based on the differential.

25. The image processing program according to claim 21, wherein the magnification processing step comprises:

15 a selection step of selecting an image magnification process from different types of image magnification processes that have been prepared in advance, in accordance with the differentiability judged with the differentiability judgment step; and

an image magnification step of magnifying the original image with
20 the selected image magnification process.

26. The image processing program according to claim 21,
wherein in the differentiability judgment step, it is judged whether the differentiability in the original image is high or low; and

25 wherein, if the differentiability has been judged to be low in the differentiability judgment step, the image magnification process is carried out in the magnification processing step after a filtering process with filter characteristics approximating human vision characteristics has been performed.

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27. The image processing program according to claim 21, further comprising:

a measurement step of measuring a visual distance from a display surface on which the magnified image obtained by magnifying the original
5 image in the magnification processing step is to be displayed to a viewpoint of a person that is to view the magnified image; and

an adjustment step of adjusting a judgment criterion of the differentiability in the differentiability judgment step based on the visual distance.

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28. The image processing program according to claim 21, further comprising:

a partition step of partitioning the original image into a plurality of partial images;

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wherein in the differentiability judgment step, the differentiability of each of the partial images obtained with the partition step is judged based on human vision characteristics; and

wherein in the magnification processing step, the partial images are magnified in a manner that is adapted to their respective judged
20 differentiability.